Atty. Docket No. PIA30957/DBE/US
Application No: 10/712,740

Amendments to the Claims

Please add new claims 12- and amend the remaining claims as shown below. This listing of Claims replaces all prior versions and listings of the Claims in this application.

Listing of Claims

1. (Currently Amended) A method for forming a contact using a Cu line in semiconductor fabrication, comprising:

forming a dual damascene pattern by etching a pre-metal dielectric (PMD) layer formed on a substrate, wherein the dual damascene pattern includes a contact hole portion located on the substrate and a trench portion located on the contact hole portion, the width of the contact hole portion being narrower than that of the trench portion;

depositing a tungsten diffusion barrier on sidewalls of the dual damascene pattern;

completely filling the dual damascene pattern with tungsten by depositing tungsten on the tungsten diffusion barrier to form a tungsten layer;

chemical mechanical polishing a portion of the tungsten layer over the trench portion;

etching an upper part of the tungsten layer in the trench portion so as to not expose a void in the contact hole portion, thereby forming a tungsten plug that occupies a lower part of the tungsten layer in the trench portion and the contact hole portion;

depositing a Cu diffusion barrier on the tungsten plug;

depositing a Cu on the Cu diffusion barrier; and

removing a portion of the Cu outside of the trench portion by a Cu chemical mechanical polishing process.

2. (Currently Amended) A method as defined in claim 1, wherein etching the tungsten in the trench portion ~~is dry etched so that~~ does not expose the tungsten in the contact hole portion ~~is not exposed~~.

3. (Original) A method as defined in claim 2, wherein the tungsten diffusion barrier includes a titanium layer and a titanium nitride layer.

4. (Original) A method as defined in claim 3, wherein the Cu diffusion barrier includes a tantalum layer and a tantalum nitride layer.

5. (Cancelled)

6. (Cancelled)

7. (Currently Amended) A method as defined in claim 4, wherein the tungsten diffusion barrier ~~is~~ comprises a Ti/TiN double layer.

8. (Currently Amended) A method as defined in claim 7, wherein the ~~thickness of~~ Ti/TiN ~~is~~ has a thickness of 30/5 nm.

9. (Currently Amended) A method as defined in claim 7, wherein the Cu diffusion barrier ~~is~~ comprises a Ta/TaN double layer.

10. (Currently Amended) A method as defined in claim 9, wherein the ~~thickness of~~ Ta/TaN ~~is~~ has a thickness of 7.7/7.5 nm.

11. (Previously Presented) A method as defined in claim 9, wherein the Ti/TiN double layer is thicker than the Ta/TaN double layer.

12. (New) A method for forming a Cu line, comprising:

etching a dielectric layer on a substrate to form a dual damascene pattern including a contact hole portion on the substrate and a trench portion on the contact hole portion, the width of the contact hole portion being narrower than that of the trench portion;

depositing a first diffusion barrier layer on sidewalls of the dual damascene pattern;

depositing tungsten on the first diffusion barrier to completely fill the dual damascene pattern with tungsten;

removing part of the tungsten in the trench portion so as to not expose tungsten in the contact hole portion;

depositing a second diffusion barrier layer on the unremoved tungsten;

depositing Cu on the second diffusion barrier layer; and

chemical mechanical polishing the Cu outside of the trench portion.

13. (New) A method as defined in claim 12, wherein removing part of the tungsten in the trench portion comprises chemical mechanical polishing a portion of the tungsten over the trench portion, and etching an upper part of the tungsten layer in the trench portion so as to not expose tungsten in the contact hole portion, thereby forming a tungsten plug in the contact hole portion and in a lower part of in the trench portion.

14. (New) A method as defined in claim 12, wherein the first diffusion barrier layer prevents diffusion of tungsten.

15. (New) A method as defined in claim 12, wherein the first diffusion barrier layer includes a titanium layer and a titanium nitride layer.

16. (New) A method as defined in claim 14, wherein the second diffusion barrier layer prevents diffusion of Cu.

17. (New) A method as defined in claim 15, wherein the second diffusion barrier layer includes a tantalum layer and a tantalum nitride layer.

18. (New) A method as defined in claim 14, wherein the first diffusion barrier layer comprises a Ti/TiN double layer.

19. (New) A method as defined in claim 18, wherein the Ti/TiN has a thickness of 30/5 nm.

20. (New) A method as defined in claim 16, wherein the second diffusion barrier layer comprises a Ta/TaN double layer.

21. (New) A method as defined in claim 20, wherein the Ta/TaN has a thickness of 7.7/7.5 nm.

22. (New) A method as defined in claim 17, wherein the titanium and titanium nitride layers have a combined thickness greater than a combined thickness of the tantalum and tantalum nitride layers.